

## Taking Control of Coherent Superconducting Quantum Electronics

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Electronic circuits which exhibit quantum mechanical phenomena—superposition and entanglement, in particular—promise a new generation of computers capable of solving currently intractable problems, secure communication, precision metrology, detectors with unparalleled sensitivity, and an efficient route for synthesizing new materials. One of the fundamental challenges, however, in realizing quantum machines is to sustain coherence over a time interval practical for performing coherent operations or computation. Until now, boosting coherence has involved hardware development to minimize coupling to a dissipative environment which typically transforms a quantum superposition into a classical state. Recent advances in the development of robust quantum-noise-limited microwave amplifiers and quantum bits with lifetimes in excess of 100 microseconds have enabled the use of feedback to *actively* suppress decoherence. In particular, we have been able to tailor the dissipative environment, either via measurement or excitation pulses, to stabilize quantum superposition states and coherent oscillations as well as track the evolution of single and two qubit states. These advances in precision measurement and control are key for implementing practical quantum circuits for microwave photonics and interferometry as well as simulations of exemplar many-body systems such as the Ising chain.